

# IRAD

Station for measurement of radiometric/temporal parameters of II tubes



Fig. 1. Photo of IRAD test station

### BASIC INFORMATION:

Inframet offers ITS series stations for testing image intensifier tubes using typical test methods recommended by MIL standards. ITS-P station enables measurement of photometric parameters, ITS-I station enables measurement of imaging parameters, ITS-R station enables measurement of reliability parameters, and ITS-IP enables measurement imaging and most important photometric parameters. These stations are optimal for great majority of manufacturers and users of image intensifier tubes. There are however some scientific projects when more detail testing is needed using non-MILs methods. For example radiometric sensitivity is not to be measured at 850nm wavelength but at a series of wavelength in wide range from UV to NIR. Next, non typical phosphors are sometimes used and then radiometric gain is to be measured instead of typical luminance gain. Finally, temporal parameters are important and must be measured. For such scientific projects Inframet had developed a new IRAD test station capable to measure expanded range of radiometric and temporal parameters of image intensifier tubes.

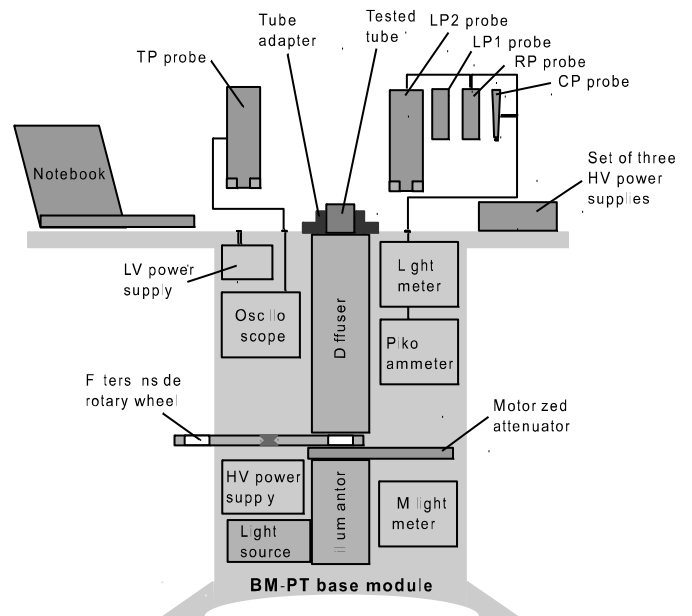


Fig.2. Block diagram of IRAD station

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## Station for measurement of radiometric/temporal parameters of II tubes

### Concept of IRAD station

The IRAD test station is a system that generate uniform illumination at the input plane of the tested II tube and enables measurements of most important photometric and temporal parameters of tested II tubes. The station is built as a modern compact stand alone test station optimised for testing II tubes (not an archaic collection of different laboratory modules to be assembled by the user on a table). Practically all image intensifier tubes can be tested (different size: 16 mm, 18 mm or 25 mm; 30mm, 40mm; different generations: II, II+, III, IV; potted tubes or bare tubes).

IRAD test station is a special model advanced version of ITS-P station for measurement of photometric parameters of image intensifier tubes.

There are significant differences in comparison to typical ITS-P station:

- a) special light source capable to emit light at at least 12 spectral bands (ITS-P station use only broadband light source)
- b) ability to measure temporal parameters - ITS-P station: no such measurements
- c) measurement of radiant emittance gain - ITS-P station: no such measurements.
- d) ultra wide spectral band up to 1200nm ( up to 900nm in ITS-P station ).

The work concept is simple. The IRAD station illuminates tube photocathode with precisely controlled light flux and measures output intensity at the tube screen using a series of measuring tools (luminance probe, radiance probe, current probe, temporal probe).

Modules of IRAD station:

1. BM-PT base module,
2. LP1 luminance probe
3. LP2 luminance probe
4. RP radiometric probe
5. CP current probe
6. TP temporal probe
7. Mechanical adapter for LP2 and TP probes
8. Set of mechanical adapters for potted and unpotted tubes (bare tubes)
9. Set of power cables for potted and unpotted tubes (bare tubes)
10. PS3 power supply (for BM-PT base module: DC12V/10A)
11. Set of three HV power supplies (option: one ultra high voltage unit can be built from two modules)
12. PC set for station control and measurements support
13. IRAD computer program
14. ITIME computer program

BM-PT is the main block of the IRAD station. BM-PT module in general serves as:

1. light source
2. rotary wheel with set of filters
3. illuminance meter
4. base holder for the tested tubes
5. DC 2.7V voltage source
6. meter for probes: CP current probe, RP radiometric probe, LP1 and LP2 luminance probes
7. oscilloscope for TP temporal probe

The light source contains two light channels: regulated polychromatic 2850K color temperature source, and the regulated 590 nm monochromatic light source for measurements of temporal parameters. Polychromatic light source has very wide illuminance range thanks to usage of computerized mechanical attenuator.

Set of filters placed in motorized rotary wheel enable measurement of photocathode radiant sensitivity and radiant emittance gain at least 12 wavelengths in the band from 400nm to 1200nm. Typical wavelengths are: 430 nm, 500 nm, 530 nm, 600 nm, 647 nm, 700 nm, 800 nm, 850 nm, 880 nm, 1000 nm, 1064 nm, 1200 nm.

IM meter is a high sensitivity illuminance meter of ultra high dynamic range that is used to measure illuminance level at the plane of photocathode of the tested II tube.

Base holder is used to fix position of the tested II tubes (after adding suitable adapters). DC 2.7V voltage source is used to power tested potted II tubes.

On the top platform of BM-PT base module two sockets for probes are located. First socket is dedicated for CP current probe, RP radiometric probe, LP1 luminance probe and LP2 luminance probe. This socket is connected to very sensitive

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picoammeter of ultra high dynamic range that is used to measure light level on the tested tube screen using RP, LP1 and LP2 probe, and to current measurements of bare tubes.

Second socket is dedicated for TP temporal probe and this socket is connected with internal oscilloscope. This configuration is used for measurements of tubes temporal parameters.

Internal source of low voltage in BM-PT module can provide power supply for any commercially available potted II tube.

Adapter to the base tube holder enable optionally fixing to the BM-PT module any potted tube available on the market (please contact Inframet and let us know the list of tubes to be tested). Inframet can provide also mechanical holders for bare tubes on the basis of data provided by the customer.

### Test capabilities

IRAD is a test station that enables measurement of photometric, radiometric and temporal parameters of image intensifier tubes needed during R&D projects. Spectral band of this station is expanded to range from 400nm to 1200nm. Measurement of photocathode radiant sensitivity and radiant emittance gain are possible at at least 12 wavelengths in the band from 400nm to 1200nm (range of typical ITS-P station is limited to 900nm). Next, the station enables testing tubes having big photocathodes. Maximal aperture of tested tubes is increased up to 40mm (typical ITS station enable testing tubes having photocathodes not bigger than 25 mm).

During photometric tests tube is uniformly illuminated. No image is created on the tube photocathode. The IRAD test station illuminates tube photocathode with precisely controlled light flux and measures output intensity at the tube screen. The IRAD station enable measurement important photometric, radiometric and temporal parameters of image intensifier tubes :

1. luminance gain,
2. radiant emittance gain,
3. saturation level
4. equivalent background input (EBI)
  1. photocathode luminous sensitivity
  2. radiant sensitivity.
  3. rise time,
  4. decay time and
  5. phosphor decay time
  6. operational stability.

The test procedures of most parameters used by the IRAD station are based on recommendations of the MIL series standards. Different versions of IRAD station of different measurement capabilities can be delivered.

### Why to test?

- Photocathode luminous sensitivity and photocathode radiometric sensitivity –parameters determine potential tube sensitivity and tubes noise.
- Luminance Gain – information how many times screen luminance is higher than illuminance at photocathode plane
- Saturation Level – information about screen brightness when tube is saturated.
- EBI – information about screen brightness when tube is not illuminated
- Radiant Emittance Gain - information how many times radiance at screen plane is higher than irradiance at photocathode plane.
- Rise time – time needed by tube to be operational
- Decay time – time needed by tube to switch off
- Phosphor decay time - parameter that describes phosphor temporal inertia
- Operational stability - information about temporal variation of screen brightness when input illumination is stable.

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## Station for measurement of radiometric/temporal parameters of II tubes

### Specifications

Modules BM-PT base module, LP1 luminance probe, LP2 luminance probe, RP radiometric probe, CP current probe, TP temporal probe, Mechanical adapter for LP2 and TP probes, Set of mechanical adapters for potted and unpotted tubes (bare tubes), Set of power cables for potted and unpotted tubes (bare tubes), PS3 power supply (for BM-PT base module: DC12V/10A), Set of three HV power supplies, PC set for station control and measurements support, IRAD computer program, ITIME computer program

### 1. BM-PT base module

#### 1.1 Light source

Light Source type polychromatic 2850K color temperature halogen source

Spectral band of halogen light source 400-1200nm

Illuminance range At least  $0.1 \cdot 10^{-6}$  lx to 0.1 lx

Regulation resolution 0.1  $\mu$ lux (at low intensity range)

Light regulation type continuous

Regulation stability better than 2% of the set value

Light measurement uncertainty better than 10%

Light source aperture At least 40 mm

#### 1.2 Spectral selector

Spectral band of light source At least 400-1200nm

Method of spectral selection A set of narrow-band optical filters on rotating wheel

Number of filters At least 12

Central wavelength of the filters 430 nm, 500 nm, 530 nm, 600 nm, 647 nm, 700 nm, 800 nm, 850 nm, 880 nm, 1000 nm, 1064 nm, 1200 nm.

Half width of the filters Not worse than 10nm

#### 1.3. Set of power supplies

Power supply no 1: Low voltage power supply DC2.7V

Power supply no 2: High voltage power supply 200-1000V (for photocathode)

Power supply no3: High voltage power supply 100-3000V (for MCP)

Power supply no 4: High voltage power supply 1.1-11kV (for screen)

Ripple <0.1%

Connection method Can be connected into a cascade

#### 1.4 Light measurement system

Illumination range  $0,1 \times 10^{-6}$  .. 200 lx

Measurement uncertainty <10%

#### 1.5 CP current probe

Current measurement range 50 pA - 100 $\mu$ A

Current resolution 10 pA

Type silicon photodiode of photopic spectral response

### 2. System for acquisition of optical signal

#### 2.1 LP1 luminance probe

Spectral range similar to human eye

Measurement range 0.05 cd/m<sup>2</sup> – 5000 cd/m<sup>2</sup>

Resolution <0.01 cd/m<sup>2</sup>

Measurement uncertainty <5%

#### 2.2 LP2 luminance probe

Type intensified silicon photodiode

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Measurement range (linear range) 10  $\mu\text{cd}/\text{m}^2$  – 1  $\text{mcd}/\text{m}^2$   
Resolution 10  $\mu\text{cd}/\text{m}^2$

### 2.3 TP temporal probe

Type broadband fast silicon photodiode  
Spectral band 400-1000nm  
Temporal inertia <50 ns

### 3. System for data processing and recording

Modules PC, frame grabber, IRAD computer program , ITIME program  
Functions 1)Acquisition of signals from picoammeter and from light probes, 2)Calculation of parameters of tested II tube, 3)Saving measurement results, 4)Presentation of measurement results in table forms

### Other data

PC communication Yes. RS232/USB 2.0  
Power AC230/110 V, 50/60 Hz (DC12V option), Max power <350W  
Operating temperature 5°C to 40°C  
Storage temperature -5°C to 60°C  
Humidity Up to 98% (non condensing)  
Mass <46 kg (including PC)  
Dimensions Overall dimensions: 540x460x550mm

\*specifications are subject to change without prior notice

*Data sheet version 1.3 dated 22.04.2014*

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